SOME INTERESTING ASPECTS OF ORIBATID ECOLOGY (ACARINA)[1]

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ABSTRACT

Food habits and habitat preferences of these mites are summarized, and their means of dispersal discussed.

Many details are known about the habits and habitats of larger animals. We are also aware of the involved effects of specific biological and physical factors within the environments. The known ecology of such microscopic organisms as oribatid mites, however, is possibly without equal with respect to the lack of information and specific details. Assumedly, the same general factors that affect the larger forms operate in the micro-environment of these mites, although the specific relationships of the various factors to the latter remain unknown except in relatively few instances.

Just how the factors differ in magnitude is yet to be determined. Undoubtedly the discovery of these details will result from refinements in the measuring and recording devices used for physical factors and in detailed studies of the micro-environment. A necessary precursor and adjunct to these studies also involves the solution of problems in the taxonomy of the species.

It is the purpose of this paper to first, present some of the known facts about the microcavernicolous environments and their inhabitants—the oribatids; secondly, to make some general statements and inferences with respect to "indicator" species; and thirdly, to attempt to explain some of the problems and possible mechanisms involved in the distribution of these forms.

Food habits represent an area of information where some facts are known. Essentially, the oribatid mites are herbivorous. They feed on all types of decaying plant material, fungi, algae and lichens. The food requirements differ for different species and the state of decomposition of the food material consumed also varies.

The litter and humus of the forest floor comprise sources of food material. In some instances the material is rough and coarse and consumed by certain species; in other situations the material must be composed of smaller pieces in order to be ingested.

Hermannia appears to feed on woody tissue, fungal hyphae, and the rougher leaf material, but only when the latter is moist. These substances are chewed, or chopped by the heavy chelicerae. Wallwork (1958) found these mites also feeding on dead bodies of their fellows. This saprozoic nutrition was observed in *Hermannia convexa* and in one other species (*Peloribates* sp.) that he studied.

Scheloribates pallidula seems to feed more on fungal hyphae than on leaf material; these mites appear to be associates and possibly commensals of wood-boring mites and insects. It is possible that they consume woody materials and frass. The writer and Wallwork (l.c.) observed this mite in tunnels of wood-boring forms. Wallwork noticed that food particles that collected on the hairs of the legs of this mite were passed forward by the mite to anterior legs in succession until the particles were finally handled by the palps and macerated by the chelicerae.

Achipteria sp. appears to feed on leaf epidermis and moss stems. The nymphs are possibly coprophagous.

Peloribates sp., one of the haplozetid mites, feeds on organic material that is in an advanced state of decay, according to Wallwork (l.c.).

The box mites or the phthiracarids seem to be principally xylophagous. They have rough, stout, serrated chelicerae with which to handle tough plant tissues. Both the nymphs and adults are inhabitants of the litter and Jacot (1939) indicates that they hollow out pine needles. They also burrow in twigs, where the writer has observed them in tunnels excavated by their cheliceral activities.

Mesoplophora, a phthiracaroid, seems to eat shredded woody elements, decaying woody material, and some fungal spores.

Small twigs, punk, bark, and rotted logs contain the burrowers of the oribatids. Nymphs and adults of *Cymberemaeus* inhabit the surface of the scaly twigs of pines and spruces, playing "possum" when disturbed and hardly distinguishable from the plant scales, except in movement. Wallwork (1958) found nymphs of *Hermannia* in the lenticels of yellow birch twigs, where they fed on the dark material of the lenticels themselves. The absence of the nymphs from the lenticels except at certain times and their feeding habits in the burrows of the adults seemed to indicate they were coprophagous.

Hoplophora magna and *Pseudotritia* sp. are definitely burrowers in twigs, where they chisel out complex tunnels in the heart wood and beneath the bark (Wallwork, l.c.). They parallel in part the work of the bark beetles. Rohde

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(1955) found that nymphs of *Pseudotritia* required a fecal meal for survival and maturation, which implies that these organisms may be similar to the termites in their biological relationships and may constitute another striking example of mutualism in animals.

Cepheus sp. is fairly common in punky wood and in association with galleries of other burrowing forms. The nymphs are camouflaged and possess elaborate spiny plates and shields on their backs. These spines and shields are actually the exuviae of preceding stages, piled one on top of the other as the nymph grows.

One of the tiniest of oribatid mites, *Oppia*, appears to be coprophagous in woody situations (Wallwork 1958). It might have other feeding habits in other types of environment, however, because the writer has found this is also an inhabitant of pasture and grassy sod, where one would expect little woody tissue.

Rotting wood, punk, and moss-covered stumps constitute the general location for *Cepheus*, *Tenuiala*, *Nothrus* and *Camisia*. It appears also that altitude affects the distribution of some of these mites, although more data are needed to verify this conclusion.

In the strict soil environment where the vegetation may be sparse the hypochthoniid *Eniochthonius* (*Hypochthoniella*) appears to feed on finer organic particles and occasionally on fungal spores. *Tectocepheus velatus* probably subsists on finer particles also, but Wallwork (1958) watched this species for a long time without observing or determining its specific food requirements.

Others in the pasture sod about which statements have already been made regarding food habits are *Scheloribates* and *Oppia*. *Pseudotritia ardua* and *P. loricata* also occur in pasture soil. The noticeably "winged" mites of the genus *Galumna* are fewer in this type of environment than the oribatulids such as *Scheloribates*, *Oribatula* or *Zygoribatula*, and information on their food habits is lacking. *Epilohmannia* is another "rare" inhabitant of this environment.

Large numbers of *Malaconothrus* sp. have been found in moss chopped out of the icy banks of the Cache la Poudre River near Bellvue, Colorado. The populations of these mites seem to be much greater during the winter than at other seasons; the nymphs are more abundant than adults, which general findings agree with those of Wallwork (1958) for Michigan.

Obviously, temperature, food requirements, moisture, soil texture needs, and other influences of these mites differ. In addition the mites themselves play relatively different roles in the attack and decomposition of the litter and humus.

If any species can be called an "indicator" species, *Tectocepheus velatus* qualifies. This organism is ubiquitous in samples, although the number of specimens may vary. It is most common in sandy soil, sandy humus, or sandy moss.

Species of *Eremaeus* occur elsewhere, but are most common in dry, sandy habitats. In a relict pinion pine grove in northern Colorado, they are abundant in the very dry, light, sandy duff beneath the pines—a situation where one perhaps would not expect to find many mites. *Cymberemaeus* is found here also.

The montane passes, peaks, the tundra and moss of areas 8–10,000 feet show relatively large numbers of *Camisia biverrucata* and *Nothrus* sp. as well as haplozetids and carabodids.

It is impossible in a short paper to discuss all of the facets of oribatid ecology, but these details may help to give a picture of some of the interesting aspects.

One obvious question that arises respecting these mites is their means of dispersal. In conclusion, therefore, some possible explanations are presented.

Distributional data may be lacking because of faulty or incomplete collecting techniques. Perhaps one misses specific microhabitats of some mites in his collecting. The palaeacarid *Acaronychus traghardi* was collected by the writer near Idaho Springs, Colorado, in very wet moss. Jacot collected it in North Carolina, and the writer has a few specimens from Yangambi, Belgian Congo. Cymeremaeids are known from Maryland, Colorado, California, and Oregon. In between the collection areas of both of these species there exists a void of information on them. Similar records exist for *Epilohmannia*. This absence of information on the distribution of these various mites the writer attributes to incomplete collecting.

Some European species are found in the United States; still other species seem to be indigenous to this country, and the question naturally arises, "How are these mites distributed?"

Wind is the first possible means. Freeman (1946) found mites at 300 feet in the air, Glick (1939) picked them up at 3,000 ft. Gislen (1948) showed that mites may remain suspended in air for several days. Dalenius (1958) demonstrated that oribatids survive drought and low temperatures, and indicated that some species were transported in the air, but discounted the possibility of their being transported freely in the air over long distances.

Jacot (1934) also doubted that oribatids could be transported over large bodies of water, and was extremely doubtful of extracontinental distribution by wind alone.

Water also has been postulated as a means of oribatid distribution. André (1947) assumed that these mites were carried in moss and lichens on floating wood. The agency of flotsam of this type, in which tunneling forms might be found, was discounted as a means by Jacot (1934) as

"arm-chair, fireside romanticism" because of the pounding, grinding action of the surf.

The most probable explanations for distributive means involve animals. Ethnological evidence seems to indicate a good possibility in man himself, whose transportation of plants, shrubs, fetish material, and wood from one land area to another, provides a rather logical explanation, since these organisms are soil and wood inhabitants.

The most generally accepted possibility is the means attributed to birds, whose migratory habits have definitely been correlated with the distribution of mosses (personal communication with Dr. Persson, Bryologist, Stockholm). Oribatids are "moss mites" and logically might be transported in this fashion. Dalenius (1958) also indicates that nest material of birds and soil adhering to the feet and feathers might contain eggs and nymphs, possibly even adults, and that these forms became dispersed by avian carriers in their migratory flights.

In all the aspects of biology, ecology, and distribution of the oribatids we need to know more. One discovery is certain, however, and that is the never-ending, amazing details that a study of these tiny creatures reveals.

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